



EFFECT OF GUIDED AND UNGUIDED DISCOVERY METHODS ON SENIOR SECONDARY ONE STUDENTS' RETENTION IN BIOLOGY IN NSUKKA EDUCATION ZONE

Odo Martha Chigozie & Prof. Mrs. Olive I. Neboh

Department of Science Education, Enugu state University of Science
And Technology (ESUT), Enugu

ABSTRACT

The research investigates effects of guided and unguided discovery methods on students' retention in biology in Nsukka education zone. The sample comprises 155 SS1 students from secondary schools in Nsukka Educational Zone of Enugu State. The experimental group was exposed to guided discovery method while the control group was exposed to unguided discovery method. Data were collected using Biology Retention Test (BRT) which was validated by three experts, content validity was ensured using Test Blue Print (TBP) and Reliability indices of 0.89 was obtained using Kuder Richardson formula 20 (K-R-20). The research questions were answered using mean and standard deviation while the research hypotheses were tested using Analysis of Covariance (ANCOVA) at .05 level. The findings revealed that there is a significant difference in the mean retention score of students taught using guided discovery method and those taught using unguided discovery method. Based on the finding, the researcher recommends among others that Biology teachers should adopt the use of guided discovery method of teaching over the unguided discovery method for enhancing academic retention. It also establishes that science educators and curriculum planners should incorporate innovative pedagogical strategies like guided discovery method in science teaching.

Keywords: Guided and Unguided Discovery, Retention and Biology.

INTRODUCTION

Etymologically, the term biology is a coinage of two Greek words; bios (life) and logos (study, science). Therefore, it is the study of life or science of life. Biology as a branch of study occupies a unique position in secondary school curriculum because of its importance as science of life. According to Ofoegbu (2013), Biology is a science subject offered in secondary schools by majority of the students and in most schools, it is optional for all students because, it is one of the core subjects. It is therefore, a science subject that enables students to acquire the knowledge to live effectively in the modern age of science and technology. It is a natural science that deals with the living world: how the world is structured, how it functions and what these functions are, how living things came into existence, and how they react to one another and with their environment (Umar, 2011). Despite the importance and popularity of biology among Nigerian students, performance



at senior secondary school level has been poor (Ahmed, 2011). The poor retention of students in Biology in external examination can be linked to the use of traditional method in teaching secondary school biology (Isiugo-Abanihe, Long John and Ibiene, 2010). The traditional teaching methods involve unidirectional flow of information/knowledge from teachers to the students and do not encourage process skill acquisition needed for proper understanding of Biological principles, concept and facts. (Guisti, 2012) referred to these traditional method of teaching as teacher - centered approaches to learning in the sense that the teacher is considered as the possessor of knowledge to be transferred to the students, and as such decides how the knowledge transfer takes place.

The traditional teaching methods (unguided discovery) results in persistent search for an effective method of teaching and learning like discovery (Akpan, 2010; Nwagbo, 2011; Mandor 2012; Ibe and Nwosu, 2013). In a traditional Biology classroom differences in the degree of guidance and assistance from the teacher as well as the degree of students' participation in the teaching and learning process can influence to a great extent the students' achievement and retention in Biology, this calls for an alternative method like discovery method of teaching that will facilitate students meaningful learning and enhance retention. Some educators, (Anyigbo, 2010; Bilgin, 2010; Guisti, 2012; and Secker, 2012) classified discovery method into two types namely guided and unguided discovery methods. Although these classifications vary, some similarities exist in the different methods (guided and unguided discovery methods). However, this study is interested in two types of discovery thus: guided and unguided discovery methods.

Guided discovery method is thus defined by kirshner, (2012) and Guisti, (2012) as the type of discovery in which students are provided with different instructional guidance by the teacher with regards to concepts and procedures required by a particular discipline, requiring students to make generalizations, the teacher develops a working plan while the students perform the activities, gather data and draw the conclusion. On the other hand, in unguided or open discovery, the students state the problems for investigation, formulate hypothesis and develop the working plan in line with stated generalization (students identify questions, discover essential information with reference to generalized principles).

Retention is the act of retaining or an ability to recall or recognize what has been learnt or experienced over a long period of time. Retention is the action of absorbing and continuing to hold a substance. Retention, according to Chauhan, (1998), is a direct correlate of positive transfer of learning. This means that high retention may lead to high achievement which is a factor of many variables such as interval between learning and retrieval, intervening experiences, specific subject involved, teaching strategies/methods used, and environmental situations, among others. In view of the limited studies, the researcher considers it necessary to explore the efficacy of discovery method (guided and unguided) on students' retention in Biology. Okoro, (2011) identified lack of retention as the major causes of students' poor achievement in Biology. Innovative teaching methods enhance achievement and promote students retention in Biology Jensen, (2018).



The study employed John Dewey's Cognitive Theory and L. S Vygosky's Learning Theory. John Dewey's theory in this study is that in the learning process, students must be engaged in meaningful activities that induce them to apply the concepts they are trying to learn. The teacher's roles should be to provide enabling environment for active learning to take place such an environment could be guided discovery approach. On the other hand, L.S Vygosky as social constructivist believed that learning take place through social interaction. Vygosky believed that the zone of proximal development of a child is the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under guidance or in collaboration with more capable peers. The popular opinion in Nigeria today is that the standard of education has fallen short of what it should be. This fall in the standard of education is perceived by many as the inability of the teachers to impart knowledge to the learners the way they will understand and write well in examinations. The work has an overriding significance because of its relevance to scholarship. Practically, the finding of this study will be beneficial to stakeholders in the educational sector. These stakeholders include curriculum planners, government, teachers and students. If a good method of discovery is identified, curriculum planners will be provided with information that may be used in recommending effective teaching methods. They will recommend it to be used for effective teaching, by including in the curriculum plan that will be circulated to all Educational institution. The finding of the study will be beneficial to students because, the discovery methods will be useful to enhance students' retention as well as help them retain what they have learnt, with discovery method students will be provided with opportunity to explore the world of things around them through the scientific process if the teachers will apply and use them in the classroom.

The findings will be useful to classroom teachers who decide what methods of teaching to use, the findings of this study will provide a guide for choosing a better method of teaching which is guided and unguided discovery method. It will make teachers more effective and efficient in teaching, if discovery method is applied in the classroom. Findings will provide information which will inform the government on the need for workshops, seminars and conferences on the use of a better method (guided and unguided) of teaching Biology. The finding of the study will also provide an insight into other subjects on the type of discovery teaching methods that will be used to enhance student's achievement and retention.

In most secondary schools, traditional method of teaching especially in Biology is in vogue, leading to poor performance of students in the senior secondary school certificate examination in Biology. Empirical studies involving guided and unguided discovery teaching methods are few in numbers from the available literature known to the researcher and none of them captures retention which is an important aspect of knowledge. This has led the researcher into investigating the effect of discovery methods (guided and unguided) in enhancing students' retention in Biology. Hence the problem put in question form is:



How far can the effect of guided and unguided discovery methods on students' retention in Biology be determined.

PURPOSE OF THE STUDY

The main purpose of this study is to investigate the effect of guided and unguided Discovery methods on students' retention in secondary school Biology. Specifically, the study sought to determine the:

- i. Effect of guided and unguided discovery methods of teaching on SS1 Student's retention in Biology.
- ii. Effect of the unguided discovery method and lecture method of teaching on student's retention in Biology.

RESEARCH QUESTIONS

The following research questions were posed to guide the study:

1. What are the mean retention and standard deviation scores of SS1 students taught Animal Nutrition using guided and unguided discovery methods?
2. What are the mean retention and standard deviation scores of SS1 students taught Animal Nutrition using unguided and lecture method?

HYPOTHESES

The following hypotheses were formulated to guide the study and were tested at a probability level of .05.

- HO₁. There is no significant difference in the mean retention test scores of SS1 students taught Animal Nutrition using guided discovery method and those taught using unguided discovery method.
- HO₂. There is no significant difference in the mean retention test scores of SS1 students taught Animal Nutrition using unguided discovery method and those taught using lecture method.

METHOD

Each item in the pre-test, post-test and retention test were scored (1) mark each. The maximum mark was (40) while the lowest mark was zero (0), but during analysis the scores were converted to 100%. The pre-test, post-test and retention test was administered and collected by the research assistants but marked by the researcher based on the marks awarded and using the marking scheme. The scores obtained from the pre-test and post-test that answered the research questions were analysed using mean and standard deviation. This was because mean is regarded as the most reliable measure of central tendency while standard deviation is the most reliable estimate of variability (Nworgu, 2006). Mean and standard deviation were used to answer research questions while analysis of co- variance (ANCOVA) statistic was used to test the hypotheses at .05 level of significance. ANCOVA



was used to correct the error of assumed initial differences in ability levels among the research subjects.

The design of the study is quasi experimental design of non-equivalent control group design. It is considered appropriate for the study because intact classes will be used to avoid disruption of normal class lesson; there will be no randomization of the subjects. According to Nworgu (2016) Non-equivalent control group design is used when a researcher is not allowed to use random assignment of subjects or groups. Nworgu maintained that quasi-experiments are sometimes called Natural experiments because membership in the treatment level is determined by the conditions beyond the control of the experiment. The study was carried out in Nsukka Education zone of Enugu state. The zone consists of three local Government Areas namely Igbo-Etiti, Nsukka and Uzo-uwani. The study was delimited to secondary schools in Nsukka local Government area. The choice of the area is because the researcher is familiar with the locations of all the schools within the area, which will give the researcher the opportunity to monitor and supervise the experiment properly. The Population for the study comprised 6205 senior secondary school class one (SSS1) students who were offering Biology in all the government co-educational senior secondary schools in Nsukka Education zone, there are about 60 government secondary schools in Nsukka Education zone, 51 CO-educational schools and 9 single schools. (Source: PPSMB 2017/2018 Statistics). The choice of SS1 Students was because Animal nutrition is the topic taught to SS1 class as contained in the Biology core curriculum of the Federal Ministry of Education (FME,2011) for senior secondary one(SS1). The research subjects for the study were 155 senior secondary school one (SS1) Biology students. Out of the 48 co-educational schools ,Community secondary school Ukehe and Community secondary school Aku were selected based on purposive random sampling, three classes from each school were randomly sampled , one class for guided, the other for unguided and the third class for lecture method, in each of the school sampled making it (6) classes altogether. There are 78 students in school 1 (39 males and 39 females) and 77 students in school 2 (36 males and 41 females). The number of students in experimental group 1 (guided) is 53 students made up of 26 male and 27 females, that in experimental group 2 (unguided) is 53 students made up of 24 male and 29 female, while that in control group (lecture) is 49 students made up of 25 male and 24 female. The sampled schools were selected putting into consideration the availability of the three (3) class streams in their SS1 classes. This will be required because three teaching methods will be used, (guided, unguided Discovery and lecture teaching methods).One of the classes sampled for guided Discovery were taught using guided Discovery teaching method, the other selected for unguided Discovery were taught using unguided Discovery teaching method while third class selected for lecture method were taught using lecture method. Using Simple Random Sampling Technique by balloting (See Appendix E for population distribution). The instrument used for data collection was Biology Achievement Test (BAT) on Nutrition in Animal. The BAT a 40- item test package, developed by the researcher from the areas of the study, The BAT comprises 40 multiple



choice questions with four (4) options (A-D) in each question. Questions were formulated from the contents of the lesson on Nutrition in Animal. The Biology Achievement Test on Nutrition in Animal will be used for pre-test, post test and Retention Test. The pre BAT and Post BAT will be the same set of questions but the questions will be reshuffled (i.e. renumbered) in the post-BAT to make it look different at face value. The initial draft of the instrument, Biology Achievement Test on Animal Nutrition (BAT) was subjected to face validation by three (3) experts, Two (2) in Biology Education and one in Measurement and Evaluation from the Department of Science and Computer Education, Enugu State University Of Science and Technology (ESUT). The experts validated the instrument in terms of clarity, proper wording, appropriateness and adequacy of the items in addressing the purpose and the problems of the study. After the validation, 40 out of 50 multiple choice objective questions survived the face validation. The advice of the validators helped to modify, and select the set of items that will be used for data collections. Content Validity was done using Test Blue-Print which was developed by the researcher and also validated by the experts. The Test Blue-Print (See Appendix A) was used to determine the spread and allocation of questions in the various levels of Cognitive Domain of the Bloom Taxonomy and the content areas. After the validation critical appraisal and comments of the experts were used to modify the items to give the final instrument. Scores of the Biology achievement test result that were obtained from trial testing were used to estimate the internal consistency of the reliability co-efficient of the instrument using Kuder-Richardson formula (k-R-20). A reliability co-efficient of 0.89 was obtained. Kuder-Richardson (k-R-20) was used because the test items consisted of multiple choice objective questions that were dichotomously scored.

Experimental Procedure:

During the treatment, the control group was taught with lecture method which is a method that is not rooted in discovery method. Here the teacher provides information to the students up front without much interaction from the students' side except for sometimes answering questions. Here, the experimental group 1 were treated using guided discovery teaching method, here the students were taught based on the different topics that the researcher used in her studies which includes food substances, Balanced diet, Heterotrophic Nutrition, Mineral required by Human (micro minerals), Dentition in animals, food test and digestive enzymes. On each topic the students were guided on what to do by the research assistants. All the students were carried along by the research assistants to ensure that they understood the topic before given them test. Here, the research assistants guided the students on what to do having been trained on what to teach and the best method.

Experimental group 2 was taught using unguided Discovery teaching method. Here the students were not guided rather they were allowed to share their common ideas though under the researcher assistant's supervision. They were only given the topic and possibly



the specific objectives. The research assistants only did introduction and gave the students specific objectives which the students followed and carry out the experiment on their own in the laboratory.

RESULTS

Research Question 1

What is the mean retention and standard deviation scores of SS1 biology students taught animal nutrition using guided and unguided method?

Table 1: mean retention and standard deviation scores of SS1 biology students taught animal nutrition using guided and unguided method.

Group	N	Posttest	Σ	Retention	σ	Mean Gain
		$\bar{x}$		$\bar{x}$		
Guided	53	68.74	5.70	73.75	4.71	5.02
Unguided	53	56.83	4.16	63.30	5.23	6.47
Mean Difference	106	11.91		10.45		-1.45

Table 1 shows that the students in experimental group 1 taught animal nutrition using guided discovery method had posttest score of 68.74 with standard deviation score of 5.70, whereas their counterparts in experimental group 2 taught using unguided discovery method had posttest score of 56.83 and standard deviation score of 4.16. However, when given retention test, those in experimental group 1 (guided discovery method) had retention mean score of 73.75 and standard deviation score of 4.71, while those in experimental group 2 had retention mean score of 63.30 and standard deviation score of 5.23. Hence, students taught animal nutrition using guided discovery method retained better than their counterparts taught using lecture method.

HYPOTHESIS

Table 2: ANCOVA analysis of mean retention score of SS1 students taught Animal Nutrition using guided discovery method and those taught using unguided discovery method.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Decision
Corrected Model	2922.109 ^a	3	974.036	38.987	0.000	
Intercept	495955.086	1	495955.086	19851.392	0.000	
GROUP	2852.163	1	2852.163	114.162	0.000	S
SEX	24.015	1	24.015	0.961	0.329	



GROUP * SEX	2.730	1	2.730	0.109	0.742	NS
Error	2548.306	102	24.983			
Total	503260.000	106				
Corrected Total	5470.415	105				

HO₁. There is no significant difference in the mean retention test scores of SS1 students taught Animal Nutrition using guided discovery method and those taught using unguided discovery method.

Table 2 shows that the F-value on mean retention score of students taught animal nutrition using guided discovery method and unguided discovery method is 114.162 which is significant at 0.000 level of significant, which is less than 0.05 level of significant set for the study. Therefore, the null hypothesis is rejected; this means that there is a significant difference in the mean retention scores of SS1 students taught Animal Nutrition using guided discovery method and those taught using unguided discovery method.

Research Question 2

What is the mean retention and standard deviation scores of SS1 biology students taught animal nutrition using unguided discovery and lecture method?

Table 3: mean retention and standard deviation scores of SS1 biology students taught animal nutrition using unguided discovery and lecture method.

Group	N	Posttest	Retention		Mean Gain	
		$\bar{x}$	Σ	$\bar{x}$		
Unguided	53	56.83	4.16	63.30	5.23	6.47
Lecture	49	47.27	4.79	45.31	3.32	-1.96
Mean Difference	102	9.56		18.00		8.43

Table 3 shows that the students in experimental group 2 taught animal nutrition using unguided discovery method had posttest score of 56.83 with standard deviation score of 4.16, whereas their counterparts in control group taught using lecture method had posttest score of 47.27 and standard deviation score of 4.79. However, when given retention test, those in experimental group 2 (unguided discovery method) had retention mean score of 63.30 and standard deviation score of 5.23, while those in control group had retention mean score of 45.31 and standard deviation score of 3.32. Students taught animal nutrition using unguided discovery method had gain score of 6.47 while those taught using lecture teaching strategy had lost score of -1.96. Since the gain score of experimental group 2 is greater than



that of control group. Hence, students taught animal nutrition using unguided discovery method retained better than their counterparts taught using lecture method.

Table 4: ANCOVA analysis of mean retention score of SS1 students taught Animal Nutrition using unguided discovery method and those taught using lecture method.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Decision
Corrected Model	8268.557 ^a	3	2756.186	140.065	0.000	
Intercept	299326.093	1	299326.093	15211.291	0.000	
GROUP	8259.670	1	8259.670	419.744	0.000	S
SEX	5.085	1	5.085	0.258	0.612	NS
GROUP * SEX	17.374	1	17.374	0.883	0.350	NS
Error	1928.433	98	19.678			
Total	314909.000	102				
Corrected Total	10196.990	101				

HO₂. There is no significant difference in the mean retention test scores of SS1 students taught Animal Nutrition using unguided discovery method and those taught using lecture method.

Table 4 shows that the F-value on mean retention score of students taught animal nutrition using unguided discovery method and lecture method is 419.744 which is significant at 0.000 level of significant, which is less than 0.05 level of significant set for the study. Therefore, the null hypothesis is rejected; this means that there is a significant difference in the mean retention scores of SS1 students taught Animal Nutrition using unguided discovery method and those taught using lecture method.

SUMMARY OF FINDINGS

Result of the analysis as presented revealed that Students taught animal nutrition with guided discovery method retained more in the retention test than those taught with unguided discovery method. Also, there is a significant difference in their mean retention scores. There is no significant difference in the mean retention test scores of SS1 students taught Animal Nutrition using unguided discovery method and those taught using lecture method.

DISCUSSION OF FINDINGS

Findings of this study show that those students taught with guided discovery method retained more than those students taught using unguided discovery method of teaching. Guided discovery method of teaching enhanced the students' ability to retain more than using the unguided discovery method. This result is in line with Moa and Chang, (2012),



Savilay, (2015), and Oriade, (2016) who indicated that guided discovery method improves students' retention in science. The findings of this study reveal that students taught with guided discovery method retained more than those taught with unguided discovery method of teaching. The findings of this study also reveals that there is no significant difference in the mean retention test scores of SS1 students taught Animal Nutrition using unguided discovery method and those taught using lecture method.

CONCLUSIONS

The findings of this study revealed that students taught using guided discovery method of teaching performed better in Biology Retention Test (BRT) than those taught using unguided discovery method.

EDUCATIONAL IMPLICATIONS

The results and conclusions reached during the course of this study clearly highlight the effectiveness of guided discovery method of teaching in raising students' retention. These findings certainly have a number of important implications.

1. The study demonstrates that the students taught using guided discovery method of teaching retain significantly higher than those taught using unguided discovery method. Hence, academic retention can be enhanced through guided discovery teaching method.
2. Guided discovery methods has to do with providing students with different instructional guidance by the teacher with regards to concepts and procedures required by a particular discipline requiring students to make generalizations, the teacher develops working plan while the students performed the activities, gather data and draw the conclusions. This suggest that the teacher needs to be trained in guided discovery teaching procedures so that they may employ the guided discovery method effectively to achieve the goal of maximum students' achievement.
3. Because of the type of teaching discovery method of teaching is, the significance of the role of teacher cannot be ignored if it is to be used effectively in actual classroom condition. It therefore, becomes implied that the teacher educators should incorporate the theoretical and practical aspects of guided discovery method of teaching.
4. Despite necessary training to teachers in the use of guided discovery method of teaching and allowing them some freedom in organizing their classes and resources, it would not be pragmatic to expect teachers to prepare and provide all the necessary materials to the students. It is, therefore, necessary that curriculum developers should prepare packages of instructional materials which may be used by teachers in their actual working conditions with slight adaptations, if so demanded by actual classroom situations.



RECOMMENDATIONS

Based on the findings of the study, the following recommendations are proffered:

1. In-service training in the form of workshops, conferences, and seminars should be organized by government to equip teachers to incorporate guided discovery teaching method in science teaching.
2. Science educators and curriculum planners should incorporate innovative pedagogical strategies like guided discovery teaching method into their various teacher education programs.
3. Teachers should be encouraged by the government to use guided discovery teaching method to teach Biology and other science, technology, mathematics, engineering subjects in secondary schools.

REFERENCES

- Anyigbo, S.C (2015). Effect of Guided Discovery Method, Cognitive Styles and Cognitive Development on Senior Secondary School Students in physics. *Unpublished M. Ed Thesis*, Department of Science Education, University of Nigeria, Nsukka.
- Chaung and Moa,(2012).Teaching in a multimedia computer Environment. A study of the effects of learning style, gender and maths achievement. *Interactive multimedia electronic journal of computer-Enhanced learning*, 1(1).
- Educational Broadcasting Corporation (2004). *Concepts to classroom workshop: constructivism as a paradigm for teaching and learning* (on line) Available, @<http://www.thirteen.org/eduonline/concept2class/constructivism/index.html>.
- Federal ministry of Education (2011).*The development of Education. National report of Nigeria*. Abuja: Federal ministry of Education. Abuja Nigeria:
- Federal Ministry of Education, (2010). *Senior Secondary School Curriculum Biology*. Certified Version.
- Guisti, B. M. (2012). Comparism of guided and open discovery instruction in a high school physics classroom. *Unpublished M.SC Thesis*, School of Technology Brigham Young University, USA
- Isiugo –Abanihe, M. Ifeoma, L; AND Tandi, I. (2010).Evaluation of the Methodology Aspect of Science Teacher Education Curriculum in Nigeria. *Pakistan journal of social sciences* 17(2)170.176.Available@<http://www.medwelljournals.com/fulltext/?doi=pjSsci.2010.170.170>.Retreived 01-02-2021.
- Kirshner, P. A;Sweller, J. and Clark, R. E (2012). ‘Why minimal guidance During Instruction Doesn’t work:*An analysis of the failuire of Constructivist, discovery, problem-based, Experimental and discovery based teaching*.
- Nwagbo, C and Chikelu, U (2011). Effect of Biology Practical Activities on Students Process Skill Acquisition in Abonyi (Ed) *Journal of the Science Teachers Association of Nigeria*, 46(1),58-70.



- Nwagbo, C. R. (2011). Effect of Guided –Discovery Expository Teaching Methods on the Attitude towards Biology Students of Different Levels of Scientific Literacy. *Journal of Science Teachers Association of Nigeria*.34 (1 and 2):66-73.
- Nwagbo, C. R. (2016). Effect of two teaching methods on the Achievement and Attitude to Biology of Students of Different Levels of Scientific Literacy. *International Journal of Educational Research*.216-229 (Online). Available @www.elsevier.com/locate/ijedures. Retrieved on 01-14-2021.
- Onan, F. (2012).Discovery –Based Learning and Language Teaching (Online) .Available@[File://E./discovery-based-learning-and languageteaching-1080813.html](http://File://E./discovery-based-learning-and-languageteaching-1080813.html). Retrieved 01-04-2021.
- Oriade,(2016).Effect of guided and demonstration methods on students achievement, interest and conceptual change in practical Biology in senior secondary school. Umuahia, abia state.
- Umar, L. A .(2011). Relationship between students performance in practical activities and their academics Achievement in integrated science using the NISTEP Mode of teaching. *Unpublished ph.D, Thesis* Zaria.